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Dye Sensitized Solar Cells Efforts at Risø National Laboratory

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The Danish Polymer centre has been active in Polymer Photovoltaics since the beginning of year 2000.

Several projects are under development from polymer solar cells based on macromolecular cascades to extremely thin absorber solar cells (<http://www.risoe.dk/solarcells/>).

In this contribution we address optimizations of Dye Sensitized Solar Cells (DSSCs) through the combination of important issues like semitransparency, quasi-solid-state constructions and low-cost realization of serially connected modules. DSSCs with transparency of 50% in the visible region, moderate efficiency ~1%, and long lifetime allow solar cells application in buildings elements like windows, façades and semi-transparent roofs. The use in DSSCs of gel polymer electrolytes prepared by liquid electrolyte incorporation into a polymer matrix such as poly methyl methacrylate presents encouraging results. Short circuit current (I_{sc}) of 4.45 mA cm^{-2} with an open circuit voltage (V_{oc}) of 0.5 V were recorded in standard solar cells sensitized by cis-bis(thiocyano) ruthenium(II)-bis-2,2'-bipyridine-4,4'-dicarboxylate. Up-scaling tests demonstrate the easy realization of a 625 cm^2 serially connected module which allows power extraction up to ~100mW with an I_{sc} of 25.1 mA and a V_{oc} of 10.65 V under A.M 1.5, 100 mW cm^{-2} standard conditions. Losses are minimized by using a low-current/high-voltage coupling scheme.

